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A COMPARATIVE ANALYSIS OF PROMOTION PROBABILITIES FOR MARINE CORPS FIELD GRADE OFFICERS WITH SPECIAL ATTENTION GIVEN TO GRADUATES OF THE NAVAL POSTGRADUATE SCHOOL

by

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This thesis analyzes the relationship between selection to the Marine Corps' Field grade ranks of major and lieutenant colonel and certain personal and professional characteristics. Special attention is given to officers who graduated from the Naval Postgraduate School, Monterey, California. A performance index, computed from each officer's Master Brief Sheet, is included in the models to control for differences in performance. Cross-tabulations and multivariate logistic and ordinary-least-squares regression models are used to analyze characteristics associated with selection probabilities. The results of the analysis indicate that being augmented into the regular Marine Corps, being in the pilot, combat and service support occupational specialties, and accession through the U.S. Naval Academy increase the likelihood of selection to major. For selection to lieutenant colonel, being caucasian, being in occupational specialties other than combat and being accessed through the U.S. Naval Academy or the NROTC increase selection probabilities. For both grades, above average performance, personal decorations and graduating from the Naval Postgraduate School increased the likelihood of selection.

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ABSTRACT

This thesis analyzes the relationship between selection to the Marine Corps' field grade ranks of major and lieutenant colonel and certain personal and professional characteristics. Special attention is given to officers who graduated from the Naval Postgraduate School, Monterey, California. A performance index, computed from each officer's Master Brief Sheet, is included in the models to control for differences in performance. Cross-tabulations and multivariate logistic and ordinary-least-squares regression models are used to analyze characteristics associated with selection probabilities. The results of the analysis indicate that being augmented into the regular Marine Corps, being in the pilot, combat and service support occupational specialties, and accession through the U.S. Naval Academy increase the likelihood of selection to major. For selection to lieutenant colonel, being caucasian, being in occupational categories other than combat and being accessed through the U.S. Naval Academy or the NROTC increase selection probabilities. For both grades, above-average performance, personal decorations and graduating from the Naval Postgraduate School increased the likelihood of selection.

TABLE OF CONTENTS

I. INTRODUCTION

A. BACKGROUND

The Marine Corps selects officers to attend full-time, fully-funded postgraduate education institutions to fill select billets requiring postgraduate education. The two programs authorized and fully-funded by the Marine Corps are the Special Education Program (SEP) and the Advanced Degree Program (ADP). Three-quarters of all Marine Corps postgraduate students are selected under the SEP. The vast majority of SEP selectees attend the Naval Postgraduate School (NPS) located in Monterey, California. This study focuses only on NPS graduates and will not consider SEP participants who attended educational institutions other than NPS or ADP participants.

Annually, prospective Marine Corps SEP and ADP students are competitively selected by Headquarters, U.S. Marine Corps based on the officer's career potential, past performance of duty, previous academic record, and availability for assignment [Ref.1,p.9]. Once selected and transferred to their respective postgraduate institutions, these officers often follow an atypical career path which may affect their chances of promotion to major or lieutenant colonel. Focusing on Marine Corps NPS graduates between 1986 and 1994 who were in-zone for promotion in 1993 and 1994, this thesis will attempt to identify those personal and professional characteristics which may affect the promotion opportunities for NPS graduates.

B. DISCUSSION

The Marine Corps has identified and validated several hundred billets which are required to be staffed by officers who possess postgraduate-level education. The Special Education Program (SEP) and the Advanced Degree Program (ADP) were established as a means of providing the Marine Corps with a sufficient pool of qualified officers to fill these billets. Approximately three-quarters of all annual graduate education quotas are assigned to the SEP. SEP students attend the Naval Postgraduate School (NPS) at Monterey, California; the Air Force Institute of Technology (AFIT) at Dayton, Ohio; or other civilian institutions whose curricula are

approved by the Marine Corps. The vast majority of Marine Corps SEP students attend NPS. The remaining postgraduate education quotas are assigned to the ADP [Ref.1,p.2]. This study focuses only on NPS graduates as NPS graduates constitute the bulk of Marine Corps officers who participate in the Marine Corps sponsored, full-time and fully-funded postgraduate education programs.

The Naval Postgraduate School offers nineteen technical and non-technical curricula to selected Marine Corps NPS students which range in duration from eighteen to twenty-seven months [Ref.1,encl.1].

Like those officers selected to attend the Marine Corps appropriate level schools (ALS), e.g., Amphibious Warfare School, Command and Staff College, etc., prospective NPS students are competitively chosen for assignment by selection boards convened annually at Headquarters, U.S. Marine Corps. Selection for the SEP is extremely competitive. In FY 1995, for example, only 45 percent of eligible officers who submitted applications were selected to attend NPS [Ref.2,p.8]. However, unlike ALS students, officers soliciting to attend NPS must first submit an administrative request and application through their chains of command for command approval and endorsements. Hence, NPS students may be considered competitively selected *volunteers*. Further, the majority of NPS students can expect to be diverted away from their typical career paths for five years (about two years actually attending NPS followed by a three year "pay-back" tour) depending on the officer's MOS and the selected curriculum. The remainder of NPS students are assigned curricula that coincide with their primary military occupational specialty.

C. PURPOSE OF THE STUDY

The first objective of this study is to build credible models which estimate the effects of personal and professional characteristics on promotion to major and lieutenant colonel in the U.S. Marine Corps. The second objective is to estimate promotion rates between officers who attended and graduated from NPS and officers who did not attend NPS when all other factors in the models are considered and held constant.

D. ORGANIZATION OF THE STUDY

Chapter II presents a review of relevant literature on the effects of graduate education, as well as other professional and personal characteristics, on officer's promotion, performance, and productivity.

Chapter III describes this study's data collection and methodology and includes the sources of the data and how the data will be organized and modeled.

Chapter IV presents and discusses the results of the analysis concerning the effects of certain personal and professional characteristics on promotion to major and lieutenant colonel.

Chapter V presents the conclusions of this study.

II. LITERATURE REVIEW

Most of the literature analyzing the impact of graduate education on officers in the U.S. military compare the differing rates of productivity, promotion and retention between officers who had received graduate education and officers who had not received graduate education. Styles and methodologies differ, but these studies focus on similar research questions--are officers who have graduate-level education more productive than officers who do not have graduate-level education? Are graduate-level-educated officers promoted faster and more often than officers who do not have graduate-level education? And are graduate-level-educated officers retained by their respective services at rates higher than officers who do not have graduate-level education? This study, however, focuses only on the effects of NPS graduate-level education on promotion to the Marine Corps field grade ranks of major and lieutenant colonel.

Cymrot, reference 3, studied the effects of U.S. Navy, fully-funded, graduate education on productivity. Cymrot theorized that "...graduate education makes officers more productive ...(thereby) ...improving the national defense" [Ref.3,p.1]. Cymrot did not have fitness report data to measure productivity. He therefore used promotion to the next higher grade as a proxy for productivity arguing that "...if graduate-educated officers get promoted faster and to higher ranks than other officers, this better record indicates that graduate education increases productivity" [Ref.3,p.1].

Using the Officer Master File which contained observations of all U.S. Navy officers on active duty in March 1985, Cymrot modeled promotion to lieutenant commander through the flag grades as a function of graduate education, time-in-grade, continuous service, race, gender, age, designator and length of service. Cymrot found that graduate education increased the probability of selection to lieutenant commander by 26 percentage points, to commander by 10.6 percentage points, and to captain by 16.5 percentage points. Graduate education had no statistically significant impact on promotion probabilities to the flag grades.

One of the most interesting aspects of Cymrot's research memorandum concerned the methods he used to correct for selectivity bias. Selectivity bias, as it pertains to the effects of graduate education on promotability, results when unobserved characteristics such as tenacity, competitiveness, motivation, daring, desire to excel, etc., cause one officer to be selected for graduate education over another officer and these same unobserved characteristics likewise cause that officer to be selected for promotion over another officer. In other words, selection for graduate education is based largely on an officer's promotability; therefore, the promotion probability of officers selected for graduate education may be higher than officers who were not selected for graduate education, all else equal. Cymrot attempted to correct for selectivity bias by introducing the time-in-grade and service-continuity variables. The time-in-grade variable measured the time to promotion for grades below the grade under consideration, thereby adjusting for faster promotion (greater, pre-graduate-education productivity) to the previous grades. The service-continuity variable was included to adjust for the inherent differences between officers who have continuous service and officers who do not have continuous service.

The time-in-grade variables had statistically significant and negative coefficients, indicating that officers who were promoted more quickly to the previous grades had greater probabilities for promotion to the grades under consideration. The continuous service variable was consistently positive and statistically significant indicating that officers with broken service had higher promotion probabilities and were therefore more productive than officers with continuous service. Age and designator were also significant variables indicating that older officers were more likely to be promoted than younger officers and unrestricted line officers were more likely to be promoted to lieutenant commander than either staff or restricted line officers. Designator had no statistically significant impact on promotion probabilities above the grade of lieutenant commander.

Talaga, reference 4, studied the impacts of U.S. Navy, fully-funded, graduate education on three measures of performance on officers in the surface warfare community: probability of promotion to lieutenant commander; percentage of all

lieutenant fitness reports receiving a "recommendation for accelerated promotion" or (RAP) from the reporting senior; and, the probability of receiving a RAP on the last lieutenant fitness report prior to the convening of the lieutenant commander promotion board. The assigning of RAP in the U.S. Navy is commonplace (71 percent of all lieutenant fitness reports contained a RAP and 83 percent of all lieutenants received a RAP on their last report prior to the lieutenant commander promotion board in Talaga's sample); however, RAP is extremely rare in the Marine Corps. Therefore, only the effects of graduate education on promotion to lieutenant commander are applicable and will be considered.

Data were obtained by merging the Navy Officer Master File, which contained professional and personal information on all lieutenants considered for promotion between fiscal years 1981 through 1985, with a longitudinal profile of those officer's fitness reports from the Navy Personnel Research and Development Center. RAP was the only portion of the fitness report used to estimate performance.

Talaga first developed a non-linear, maximum-likelihood, probit selection model to estimate the impact of the explanatory variables on the likelihood of being selected for fully-funded graduate education. He then incorporated the graduate-education variable into a maximum-likelihood, logit promotion model along with other professional and demographic variables to estimate the impact of fully-funded, graduate education on promotion to lieutenant commander. To correct for selectivity bias, Talaga used the Heckman and Barnow approaches. The Heckman approach is a two-stage, statistical procedure designed to purge any correlation between unobservable factors in the selection model and the error term in the promotion model. The Barnow approach, also a two-stage, statistical procedure, is designed to purge any endogeneity (selection for graduate education causes promotion) from the promotion model, thus providing a more accurate estimate of graduate education's true impact on promotion.

From his analysis, Talaga found that fully-funded, graduate education increased the likelihood of promotion by 13.6 percentage points. This percentage is significantly less than Cymrot's estimate of 26 percentage points in reference 2; however, Cymrot's technique for correcting selectivity bias more than likely failed to account for many

unobservable factors or endogeneity, thereby causing his graduate education coefficients to be overestimated. Other variables found to increase the likelihood of promotion to lieutenant commander were gender, married with children, designator, and having attended Department Head School.

Jordan, reference 5, studied the effects of graduate education on promotion and retention rates for General Unrestricted Line Officers in the grades of lieutenant commander and commander in the U.S. Navy. Data sets were constructed from pooled samples of lieutenants and lieutenant commanders and were further divided into "leavers" and "stayers" to isolate those officers who leave prior to the convening of the appropriate selection board from those officers who stayed and were promoted or who stayed and were not promoted.

Multivariate, logistic regression models were used to estimate the joint probability of voluntarily staying and being promoted to either lieutenant commander or commander as a function of gender, commissioning source, marital and dependent status, undergraduate transcripts, graduate education and graduate-school major. Graduate education was further divided into graduate education attained at the Naval Postgraduate School (NPS), Monterey, California, and graduate education attained from other universities.

From the pooled sample of lieutenants who stayed, Jordan found that a graduate degree from NPS increased the probability of promotion to lieutenant commander by 29 percent when compared to officers with no graduate degree. Note that Jordan's parameter estimate for promotion to lieutenant commander is very close to Cymrot's in reference 2 (29 and 26 percentage points respectively); however, Jordan made no effort to correct for selectivity bias. Having a graduate degree from a university other than NPS was also positive, but not statistically significant, indicating that a graduate degree obtained from a university other than NPS had no consistent effect on promotion to lieutenant commander. From the pooled sample of lieutenant commanders who stayed, Jordan found that graduating from NPS and from universities other than NPS increased the officer's promotion probability, but found that both

graduate variables had a statistically insignificant effect on the probability of promotion to commander.

From her analysis, Jordan found that graduating from the NPS has a positive and statistically significant effect on General Unrestricted Line Officer's promotion to lieutenant commander and conjectured that the NPS degree is viewed more credibly by the selection boards than graduate degrees obtained from civilian universities. Jordan had no explanation for the positive, albeit statistically insignificant relationship between graduate education and promotion to commander.

Long, reference 6, analyzed several professional and personal characteristics which affected the promotion rates for Marine Corps officers to the grades of major, lieutenant colonel and colonel. His data base consisted of all captains, majors, and lieutenant colonels in the primary zone for promotion to the next higher grade from fiscal years 1986 through 1992. Long did an excellent job in outlining the operation of Marine Corps promotion boards and defining his variables. As the title of his study indicates, Long did not use performance criteria (fitness report data) in his study.

Long's multivariate promotion models were developed using log-linear, stepwise regression techniques to determine the impact of selected variables on the estimated promotion probability to major, lieutenant colonel and colonel. Long modeled promotion to the appropriate grade as a function of race, gender, postgraduate education (master's degree and higher), occupational field, duty station, general classification test (GCT) score, marital status, combat experience, commissioning source, personal awards and attendance at an appropriate level school (ALS). For promotion to major, Long found that the following variables increased the probability of promotion to major: appropriate level school, postgraduate degree, accession through the U.S. Naval Academy, being married, and two or more personal decorations. For promotion to lieutenant colonel, statistically significant variables increasing promotion probabilities were attending an appropriate-level school, postgraduate education, duty station, and graduation from the U.S. Naval Academy. For promotion to colonel, only attendance at an appropriate level school and duty station were statistically significant variables increasing the likelihood of promotion.

From his analysis, Long found that the inclusion or exclusion of certain variables consistently forecasted different promotion probabilities between officers. Having attended an appropriate level school increased the likelihood of promotion to all three grades studied and having attained a postgraduate degree and graduating from the U.S. Naval Academy increased the likelihood of promotion to major and lieutenant colonel. The positive impact of attending an appropriate-level school on promotion is not surprising since these officers were competitively selected to attend. Race, gender, GCT score, and combat experience had no impact on promotion probabilities in any grade modeled.

North and Smith, reference 7, studied accession characteristics which affected promotions to the grades of captain and major in the U.S. Marine Corps. Data were obtained from the Basic School File and the Headquarters Master File which covered Marine Corps officer accessions from FY 1980 through FY 1991.

Bivariate, probit models were used to estimate the relationship between accession characteristics and promotion to either captain or major. The accession characteristics modeled were personal characteristics (GCT score, gender, age at accession, marital status at accession, college major, years of service, and prior military service), MOS (combat, ground support, aviation, aviation support, and service), and accession source or program (PLC/OCS, U.S. Naval Academy, Navy Reserve Officer Training Corps (NROTC) and the various Marine enlisted commissioning programs). For promotion to captain, statistically significant variable values increasing the probability of promotion were married when accessed, fewer years of service, aviation MOS, and accession through the U.S. Naval Academy. Statistically significant variable values reducing the probability for promotion to captain were racial/ethnic minority, ground support MOS, and being accessed through the PLC/OCS or the MECEP. GCT scores, age at accession, and undergraduate major did not affect promotion probabilities to captain. For promotion to major, the only statistically significant variable values increasing the probability of promotion were married at accession, and more years of military service at accession. Statistically significant variable values reducing the probability for promotion were accession through the PLC/OCS or the ECP and receiving an

undergraduate degree in engineering. GCT scores and race/ethnicity did not affect promotion probabilities to major.

Armell III, reference 8, analyzed the impact of commissioning source, gender, race and ethnicity, and military occupational specialty (MOS) on performance. The most unique aspect of Armell III's study was his ability to capture fitness report data as a criterion measure of performance. In creating his performance index (PI), he first assigned numeric values to the observations recorded in Section B, of the Marine Corps fitness report on a scale ranging from a minimum of 0 to maximum of 9. He computed a straight PI score by summing all of the scores, then divided the total sum by the number of observed marks. Armell III computed the mean PI for the entire data set at 8.32, indicating hyperinflation of fitness-report marks.

Armell III used both descriptive statistics and multivariate regression models to estimate the relationship between commissioning source, MOS, gender, race and ethnicity, GCT scores and accession region with performance. A summary of the descriptive results is provided in Table 1.

Commissioning Source	**Mean PI**	**Racial/Ethnic**	**Mean PI**
ECP and MECEP	8.63	White	8.38
U.S. Naval Academy	8.46	Other	8.31
NROTC	8.44	Hispanic	8.29
OCC and PLC	8.32	Black	8.05
MOS	**Mean PI**	**Gender**	**Mean PI**
Pilots	8.41	Female	8.38
Aviation Support	8.38	Male	8.36
Service Support	8.38		
Combat	8.37		
Ground Support	8.29		

Table 1. Descriptive Means Summarized from Reference 8.

Armell's ordinary-least-squares regression models employed the SAS procedure PROC REG to estimate the explanatory variables' impact on performance. He found that his regression results closely paralleled the findings obtained from the descriptive statistics. For example, a NROTC graduate is estimated to have a PI .03 points lower than an Academy graduate, and a Marine assessed through the enlisted commissioning program is estimated to have a PI .099 points higher than an Academy graduate. Further analysis found that blacks had an estimated PI .291 points lower than whites, and pilots were estimated to have the highest PI, .131, when compared against combat occupational specialties. There were no statistically significant PI differences between males and females [Ref.8,p.32].

Armell III's study is highly relevant as he was able to compute raw fitness report data into a credible performance index to estimate the impact of certain explanatory variables on performance. He chose fitness-report marks for the performance index since, "...fitness report material, which reflects actual on-the-job experiences of qualified officers, is preferred since it is a more direct measure of performance" [Ref.8,p.9]. Performance, as documented on fitness reports, is the single most important measure of an officer's quality and therefore the greatest promotion multiplier affecting an officer's selection or non-selection to the next highest grade.

A review of the literature indicates that attaining a graduate degree increases an officer's chances for promotion, especially when officers are competitively selected to participate in fully-funded, graduate education. What remains unclear is the ***true*** impact of graduate education on promotion. Does graduate education make on officer more productive, thereby increasing his promotability, or do the selection boards simply do a terrific job in identifying quality officers who would probably have been promoted even without graduate education? Further research needs to be done to answer this question. The literature also identifies several other professional and personal characteristics which increase an officer's promotability: surface warfare designator or MOS, married, attending an appropriate level school, and accession through the U.S. Naval Academy. Race and gender fail to have a consistent impact on promotion.

III. DATA AND METHODOLOGY

A. DATA

The data for this study were created by obtaining the 1993 and 1994 major and lieutenant colonel promotion board results from the Manpower Analysis section at Headquarters, U.S. Marine Corps. The promotion board data were merged by social security number with the Officer Master File, Master Brief Sheet data extracted from the Automated Fitness Report System (AFRS) and additional information provided by the NPS registrar's office. The data set was then separated between the captains in-zone and majors in-zone for promotion to major and lieutenant colonel respectively. Once the merging of these data sets was complete, all privacy act information to include names and social security numbers were purged from the data sets and replaced by observation numbers to protect the privacy of the officers studied. The captains in-zone for promotion data set contains 1,521 individual observations with each observation containing 183 variables. The majors in-zone for promotion data set contains 1,453 individual observations with each observation containing 183 variables. The two data sets contain virtually all of the unclassified information on these officers to include each officer's cumulative record of performance encapsulated within his/her Master Brief Sheet.

B. METHODOLOGY

Binomial logistic regression models will be used to analyze the dichotomous select/non-select rates for Marine Corps officers who were considered for selection to the grades of major and lieutenant colonel in 1993 and 1994. Four logistic models were developed for each grade to estimate the effects of various personal and professional characteristics on selection probabilities. The first logistic model in each data set incorporates a performance index computed from each officer's compilation of fitness report marks contained within their Master Brief Sheet. The second logistic model omits performance indexes and should change the strength of the explanatory variable's relationship to selection since these variables will be reflecting differences in

performance. The third and fourth logistic models, restricted to only NPS graduates, predicts promotion probabilities for NPS graduates in certain occupational specialties and NPS curricula. The fifth and sixth models were developed using the ordinary-least-squares technique to estimate performance differences between the categories studied. The following is a listing and description of the explanatory variables used in the analysis.

VARIABLE NAME	DATE SET CATEGORY	CATEGORY DESCRIPTION
Gender	Male	All male officers
	Female	All female officers
Race	White	All caucasian officers
	Non-White	All non-caucasian officers
Component	Regular	All officers augmented into the regular Marine Corps
	Reserve	All officers not augmented into the regular Marine corps
Commissioning Source	USNA	Accessed through the U.S. Naval Academy
	NROTC	Accessed through the Naval Reserve Officers Training Corps
	OCS	Accessed through the Officer Candidate Course or the Platoon Leaders Course
	Other	All officers accessed through programs not listed above

VARIABLE NAME	DATA SET CATEGORY	CATEGORY DESCRIPTION
Occupational Specialty	Combat	Infantry (03) Field Artillery (08) Tanks and Amphibious Assault Vehicles (18)
	Ground Support	Intelligence (02) Logistics (04) Combat Engineer (13) Communications (25) Signals Intelligence (26) Ground Supply (30) Motor Transport (35)
	Service Support	Adjutant and Personnel (01) Financial Management (34) Data Systems (40) Public Affairs (43) Judge Advocate (44) Military Police and Corrections (58)
	Pilots	All Pilots (75)
	Aviation Support	Aircraft Maintenance (60) Aviation Supply (66) Air Support/Air Defense Control (72) Air Traffic Control (73)
GCT Score	High	Scores greater than 134
	Medium	Scores greater than 124 and less than 135
	Low	Scores less than 125
NPS Graduate		All officers who graduated from the Naval Postgraduate School
Personal Decorations	Awards	The number of personal decorations awarded to each officer

VARIABLE NAME	DATA SET CATEGORY	CATEGORY DESCRIPTION
MOS Match	MOSmatch	MOS/Curriculum Description 01XX/Manpower, Personnel and Training Analysis 04XX/Material Movement, Transportation and Resource Management 13XX/Engineering Sciences 25XX/Communication Sciences 30XX/Procurement, Systems Acquisition and Material Management 34XX/Financial Management 40XX/Information Systems and Computer Sciences 75XX/Space Systems, Aeronautical and Avionics Engineering
Captains in-zone Performance Index	High	All computed indexes greater than or equal to 11.89 (top 20%)
	Medium	All computed indexes greater than or equal to 11.77 and less than 11.89 (top 50% to 79%)
	Low	All computed indexes less than or equal to 11.78 (bottom 49%)
Majors in-zone Performance Index	High	All computed indexes greater than or equal to 11.78 (top 20%)
	Medium	All computed indexes greater than or equal to 11.65 and less than 11.79 (top 50% to 79%)
	Low	All computed indexes less than or equal to 11.66 (bottom 49%)

A straight performance index for each officer was computed by assigning numerical scores to each of the observed performance blocks and qualities blocks on the Master Brief Sheet (MBS). Values were assigned as follows:

1 = Unsatisfactory	4 = Above Average
2 = Below Average	5 = Excellent
3 = Average	6 = Outstanding

All observed values in the performance blocks were summed then divided by the number of observed marks. The same formula was used to compute the qualities portion of the MBS. These two values were then added together giving each officer a performance index on a scale ranging from 1 to 12. The mean performance index for the captains in-zone was 11.78 with a standard deviation of .1459. The mean performance index for the majors in-zone was 11.66 with a standard deviation of .1533. The categorizing of the performance indexes was arbitrary; however, it was done in such a fashion as to discriminate between performance differences in the observations much like the promotion boards discriminate between performance differences in the officers in-zone for promotion. For example, officers who are consistently rated in the top 20 percent of their peers should have much higher promotion probabilities than officers consistently rated below the mean. Likewise, officers in the top 50 to 79 percentiles should have much higher promotion probabilities than officers below the mean but not as high as the probabilities of those officers clustered in the top 20th percentile. Still, officers below the mean are promoted. It can be hypothesized that after the top performers are selected and the poorest performers are passed-over by the selection boards, the remaining officers under consideration are so close to each other in performance, other factors studied in these models will become more relevant. In other words, when the selection process is nearly complete and with the officers still under consideration so close to each other in terms of performance, factors such as occupational specialty, race and gender are expected to take on increased relevance.

A major assumption concerning the performance indexes must now be stated. The performance indexes for the captains in-zone and majors in-zone are not evenly distributed over the full range of possible values, i.e., the mean performance index for each data set should fall somewhere between five and seven if the data were evently disbributed. Mean indexes of 11.78 and 11.66 respectively, represent hyperinflation of the marks computed. However, the following chapter will show that the promotion boards are able to discern the variations in the fitness report Section B scores and typically select those officers for major and lieutenant colonel with the higher performance indexes. It is therefore assumed that section B marks are representative of all other performance indicators contained within the fitness report.

GCT scores were similarly categorized as high (greater than 135), medium (greater than 124 and less than 135) and low (less than 125). GCT scores were categorized in this manner and inserted into the models as dummy variables rather than allowing the GCT score variable to remain continuous. It does not seem logical to assume that a one-unit-change in an officer's GCT score, 131 vice 130, for example, would have any appreciable affect on promotion probabilities. The mean GCT score of the captains in-zone was 130 with a standard deviation of 9.96 and the majors in-zone was 127 with a standard deviation of 11.62.

The number of personal awards for each officer was computed by simply summing the number of personal decorations listed on each officer's Master Brief Sheet. The mean number of awards was 1.88 awards per captain in-zone with a standard deviation of 1.45 and 2.88 awards per major in-zone with a standard deviation of 1.98. No weight was given to the awards which will tend to overemphasize the relativity of the awards coefficient. In other words, a Navy Achievement Medal and a Bronze Star both assume values of one. Since awards like the Bronze and Silver Stars and Legions of Merit are included in the awards computations and promotion boards are more likely to attach greater weight to these awards than lesser awards, the awards coefficient, when included in the models, will be likely inflated.

Finally, the data sets were restricted to only those captains and majors in their respective primary zones, freeing the data sets of the inherent differences between

officers in the primary and above zones. In 1993 and 1994, there were 1,212 captains in the primary zone for major and 578 majors in the primary zone for lieutenant colonel. The remainder of this study will consider only those officers.

IV. RESULTS OF ANALYSIS

A. DESCRIPTIVE RESULTS

Descriptive analysis of the two data sets gives great insight into what happened to different categorical groups considered for promotion to major and lieutenant colonel in 1993 and 1994. The following tables, derived by creating cross-tabulations from both the captains in-zone and majors in-zone data sets, provide each category considered, the mean performance index (PI) of the group, the number of officers selected in each group, the selection percentage, the mean PI for those selected, the number of officers passed-over, the passed-over percentage and the mean PI for those officers passed-over.

Tables 2 through 10 present information on all captains in-zone for promotion in 1993 and 1994. Tables 11 through 19 present information on all captains in-zone for promotion in 1993 and 1994 who were graduates of the Naval Postgraduate School. The tables created from the captains in-zone data set will be presented first followed by the tables created from the majors in-zone data set, Tables 20 through 34. The reader is encouraged to review all of the information in the following tables as the tables highlight selection trends and will assist the reader with interpreting and understanding the results listed in the multivariate regression tables presented in the next section.

TABLES 2 THROUGH 10

Selection for Major and Performance Index by Variables

	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Total Pop	11.78	816	67.33	11.83	396	32.76	11.67

Table 2. Selection for Major and Performance Index (Total Population).

Gender	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Female	11.76	24	80.00	11.81	6	20.00	11.58
Male	11.78	792	67.01	11.84	390	32.99	11.67

Table 3. Selection for Major and Performance Index by Gender.

Race	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
White	11.78	781	67.97	11.84	368	32.01	11.67
Non-White	11.71	35	55.56	11.78	28	45.95	11.63

Table 4. Selection for Major and Performance Index by Race.

Com Source	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
USNA	11.79	98	72.59	11.84	37	27.41	11.65
OCS	11.79	516	68.71	11.83	235	31.29	11.69
Other	11.79	75	66.37	11.86	38	33.63	11.66
NROTC	11.74	127	59.62	11.83	86	40.38	11.62

Table 5. Selection for Major and Performance Index by Commissioning Source.

PMOS	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Combat	11.80	162	68.07	11.85	76	31.93	11.67
Pilots	11.78	287	68.01	11.83	135	31.99	11.68
Service Support	11.78	106	67.52	11.84	51	32.48	11.65
Aviation Support	11.78	60	67.42	11.84	29	32.58	11.66
Ground Support	11.76	201	65.69	11.82	105	34.31	11.66

Table 6. Selection for Major and Performance Index by Primary Military Occupational Specialty (PMOS).

Comp	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Regular	11.78	785	67.97	11.84	370	32.20	11.67
Reserve	11.70	31	54.39	11.79	26	45.61	11.61

Table 7. Selection for Major and Performance Index by Component.

PI	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
High PI	11.93	224	91.80	11.94	20	08.20	11.92
Medium PI	11.84	406	81.69	11.84	91	18.31	11.82
Low PI	11.64	186	39.49	11.71	285	60.51	11.60

Table 8. Selection for Major and Performance Index by Performance Index Categories.

GCT Score	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Medium GCT	11.79	308	69.84	11.84	133	30.16	11.68
High GCT	11.79	246	68.52	11.85	113	31.48	11.65
Low GCT	11.77	262	63.59	11.82	150	36.41	11.66

Table 9. Selection for Major and Performance Index by GCT Score Categories.

NPS	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean Pi	Passed Over #	Passed Over %	Passed Over PI
NPS Grad	11.83	52	78.79	11.86	14	21.21	11.72
Non-NPS Grad	11.78	764	66.67	11.83	382	33.33	11.66

Table 10. Selection for Major and Performance Index by NPS Graduate.

From Tables 2 through 10, it is clear that groups with the highest performance indexes are being selected at rates higher than groups with the lower indexes. The only exception is between male officers and female officers in Table 3. Although males received better Section B marks on average than females, female officers had a higher selection rate than men. However, the small number of women in the data set is likely influencing these selection and passed-over percentages. The biggest differences between groups in the areas of both performance index and selection rates were between white and non-white officers and regular and reserve officers, Tables 4 and 7. Also, the performance index categories, Table 8, show vast differences in selection rates as would be expected. Notice that the mean performance indexes of those selected were, on average, above the group mean and the mean performance indexes of those officers passed-over were below the group mean.

TABLES 11 THROUGH 19

NPS Graduates Selection for Major and Performance Index by Variables

NPS	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
NPS Grad	11.83	52	78.79	11.86	14	21.21	11.72
Non-NPS Grad	11.78	764	66.67	11.83	382	33.33	11.66

Table 11. Selection for Major and Performance Index by NPS Graduate.

Gender	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Female	11.78	3	100.00	11.78	0	00.00	N/A
Male	11.84	49	77.78	11.87	14	22.22	11.72

Table 12. NPS Graduates Selection for Major and Performance Index by Gender.

Race	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
White	11.85	50	80.65	11.87	12	19.35	11.76
Non-White	11.64	2	50.00	11.74	2	50.00	11.54

Table 13. NPS Graduates Selection for Major and Performance Index by Race.

Com Source	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
NROTC	11.85	11	100.00	11.85	0	00.00	N/A
OCS	11.84	25	86.21	11.84	4	13.79	11.81
USNA	11.85	9	64.29	11.90	5	35.71	11.77
Other	11.78	7	58.33	11.86	5	41.67	11.66

Table 14. NPS Graduates Selection For Major and Performance Index by Commissioning Source.

PMOS	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Service Support	11.81	18	85.71	11.85	3	14.29	11.57
Aviation Support	11.84	5	83.33	11.86	1	16.67	11.74
Combat	11.90	8	80.00	11.92	2	20.00	11.80
Pilots	11.90	7	77.78	11.91	2	22.22	11.87
Ground Support	11.79	14	70.00	11.82	6	30.00	11.73

Table 15. NPS Graduates Selection for Major and Performance Index by Primary Military Occupational Specialty (PMOS).

PI	Mean PI	Maj Sel #	Mal Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
High PI	11.94	20	95.24	11.94	1	04.76	11.90
Medium PI	11.84	24	82.76	11.84	5	17.24	11.85
Low PI	11.67	8	50.00	11.72	8	50.00	11.63

Table 16. NPS Graduates Selection for Major and Performance Index by Performance Index Categories.

GCT Score	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Medium GCT	11.85	15	88.24	11.85	2	11.76	11.85
Low GCT	11.76	11	78.57	11.81	3	21.43	11.59
High GCT	11.85	26	74.29	11.89	9	25.71	11.74

Table 17. NPS Graduates Selection for Major and Performance Index by GCT Score Categories.

	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
MOS Match	11.83	23	88.48	11.86	3	11.54	11.67
Non-MOS Match	11.83	29	72.50	11.86	11	27.50	11.73

Table 18. NPS Graduates Selection For Major and Performance Index by PMOS Matching the NPS Curriculum.

	Mean PI	Maj Sel #	Maj Sel %	Maj Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Tech Curric	11.83	29	70.73	11.88	12	29.27	11.71
Non-Tech Curric	11.84	23	92.00	11.84	2	08.00	11.84

Table 19. NPS Graduates Selection for Major and Performance Index by Technical NPS Curriculums.

Tables 11 through 19 show that NPS graduates had both higher performance indexes and selection rates than officers who did not attend and graduate from the Naval Postgraduate School. Many of the same trends found in Tables 2 through 10 continue to exist when the data sets are restricted only to NPS graduates. The higher selection rate for NPS graduates as compared to officers who did not attend NPS is not surprising since NPS graduates had a higher mean performance index. From Tables 18 and 19, it is interesting to note the large differences in selection rates between NPS graduates whose MOS coincided with their NPS curriculum and NPS graduates whose MOS did not coincide with their NPS curriculum and between NPS graduates who were in the technical curricula and NPS graduates who were not in the technical curricula. In both instances, there were virtually no discernible differences in performance indexes.

TABLES 20 THROUGH 27

Selection for Lieutenant Colonel and Performance Index by Variables

	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Total Pop	11.66	319	55.19	11.73	259	44.81	11.58

Table 20. Selection for Lieutenant Colonel and Performance Index (Total Population).

Gender	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Female	11.60	12	63.16	11.68	7	36.84	11.45
Male	11.67	307	54.92	11.73	252	45.08	11.58

Table 21. Selection for Lieutenant Colonel and Performance Index by Gender.

Race	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
White	11.67	309	56.18	11.73	241	43.82	11.59
Non-White	11.52	10	35.71	11.66	18	64.29	11.45

Table 22. Selection for Lieutenant Colonel and Performance Index by Race.

Com Source	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
USNA	11.69	32	60.38	11.74	21	39.62	11.62
NROTC	11.65	52	55.91	11.73	41	44.09	11.56
OCS	11.66	222	55.09	11.73	181	44.09	11.57
Other	11.73	13	44.83	11.78	16	55.17	11.70

Table 23. Selection for Lieutenant Colonel an Performance Index by Commissioning Source.

PMOS	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Service Support	11.65	38	61.29	11.72	24	38.71	11.53
Pilots	11.69	103	55.08	11.75	84	44.92	11.63
Ground Support	11.60	71	55.47	11.68	57	44.53	11.50
Combat	11.69	87	54.32	11.76	73	45.63	11.61
Aviation Support	11.64	20	48.78	11.72	21	51.22	11.57

Table 24. Selection for Lieutenant Colonel and Performance Index by Primary Military Occupational Specialty (PMOS).

PI	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
High PI	11.84	109	85.16	11.84	19	14.84	11.82
Medium PI	11.73	136	68.69	11.73	62	31.31	11.72
Low PI	11.52	74	29.37	11.57	178	70.63	11.50

Table 25. Selection for Lieutenant Colonel and Performance Index by Performance Index Categories.

GCT Score	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Medium GCT	11.69	114	58.46	11.74	81	41.54	11.61
High GCT	11.69	71	58.20	11.74	51	41.80	11.61
Low GCT	11.63	134	51.34	11.72	127	48.66	11.55

Table 26. Selection for Lieutenant Colonel and Performance Index by GCT Score Categories.

NPS	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
NPS Grad	11.65	15	55.55	11.67	12	44.44	11.63
Non-NPS Grad	11.66	304	55.17	11.73	247	44.83	11.57

Table 27. Selection for Lieutenant Colonel and Performance Index by NPS Graduate.

From Tables 20 through 27, it is again clear that groups with the highest performance indexes were selected at rates higher than groups with lower performance indexes. The notable exception is again between males and females. The largest performance index gap that equates to lower selection rates exist between whites and non-whites. Officers with high and medium performance indexes had much higher promotion rates than officers clustered in the low performance index category, as expected. Notice that the differences between the performance indexes for NPS graduates and officers who did not attend NPS were negligible, thus differences in selection rates were small.

TABLES 28 THROUGH 34

NPS Graduates Selection for Lieutenant Colonel and Performance Index by Variables

NPS	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
NPS Grad	11.65	15	55.55	11.67	12	44.44	11.63
Non-NPS Grad	11.66	304	55.17	11.73	247	44.83	11.57

Table 28. Selection for Lieutenant Colonel and Performance Index by NPS Graduate.

Com Source	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Other	11.65	1	100	11.65	0	00.00	N/A
USNA	11.68	5	62.50	11.70	3	37.50	11.66
NROTC	11.67	2	50.00	11.66	2	50.00	11.69
OCS	11.63	7	50.00	11.66	7	50.00	11.61

Table 29. NPS Graduates Selection for Lieutenant Colonel and Performance Index by Commissioning Source.

PMOS	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Aviation Support	11.51	1	100	11.51	0	00.00	N/A
Ground Support	11.62	7	77.78	11.64	2	22.22	11.56
Pilots	11.67	4	44.44	11.69	5	55.56	11.66
Service Support	11.64	2	40.00	11.79	3	60.00	11.53
Combat	11.77	1	33.33	11.73	2	66.67	11.80

Table 30. NPS Graduates Selection for Lieutenant Colonel and Performance Index by Primary Military Occupational Specialty (PMOS).

PI	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
High PI	11.83	3	75.00	11.83	1	25.00	11.81
Low PI	11.57	8	53.33	11.59	7	46.67	11.54
Medium PI	11.73	4	50.00	11.71	4	50.00	11.75

Table 31. NPS Graduates Selection for Lieutenant Colonel and Performance Index by Performance Index Categories.

GCT Score	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Low GCT	11.69	6	75.00	11.79	2	25.00	11.65
Medium GCT	11.64	6	60.00	11.70	4	40.00	11.55
High GCT	11.64	3	33.33	11.65	6	66.67	11.64

Table 32. NPS Graduates Selection for Lieutenant Colonel and Performance Index by GCT Score Categories.

	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
MOS Match	11.63	4	66.67	11.69	2	33.33	11.53
Non-MOS Match	11.66	11	52.38	11.66	10	47.62	11.66

Table 33. NPS Graduates Selection for Lieutenant Colonel and Performance Index by PMOS Matching the NPS Curriculum.

	Mean PI	LtCol Sel #	LtCol Sel %	LtCol Sel Mean PI	Passed Over #	Passed Over %	Passed Over PI
Tech Curric	11.67	9	47.37	11.70	10	52.63	11.65
Non-Tech Curric	11.62	6	75.00	11.64	2	25.00	11.56

Table 34. NPS Graduates Selection for Lieutenant Colonel and Performance Index by Technical NPS Curriculums.

Tables 28 to 34 show that NPS graduates whose MOS coincided with their NPS curriculum hade higher rates of selection to lieutenant colonel than NPS graduates whose MOS and NPS curriculum did not coincide. NPS graduates who were in the non-technical curricula were promoted at a greater rate than NPS graduates who were in the technical curricula. There were no female or minority officers in this data set.

B. REGRESSION RESULTS

This section analyzes the regression results from the six models in each data set. Model 1 is a binomial logistic regression model with the selection to major or lieutenant colonel as the dependent variable. The performance index is incorporated into Model 1. Model 2 was developed exactly like model 1; however, the performance index is omitted from Model 2. Model 3 is an ordinary-least-squares regression model with the

performance index as the dependent variable which estimates the performance differences between groups. Models 4, 5 and 6 are both restricted to only NPS graduates. Model 4 is a binomial logistic regression model with selection to major as the dependent variable with performance variables included in the model. Model 5 is similarly constructed as Model 4 with the performance variables omitted. Model 6 is an ordinary-least-squares regression model with the performance index as the dependent variable.

PROMOTION TO MAJOR
MULTIVARIATE REGRESSION MODELS

	MODEL 1	MODEL 2	MODEL 3
Variable	Parameter Value	Parameter Value	Parameter Value
Male	-.2722	-.2586	-.0142
White	-.0011	.0637	.0522
Regular	.0406	.1256	.0846
USNA	.0331	-.0002	-.0175
NROTC	-.0695	-.1377	-.0577
Other Commissioning Sources	-.0603	-.0600	.0007
Pilots	.0920	.0886	.0016
Aviation Support	-.0077	-.0222	-.0247
Service Support	.0449	.0044	-.0275
Ground Support	-.0059	-.0642	-.0423
GCT Score (GE 135)	.0304	.0717	.0199
GCT Score (GE 125 & LE 134)	.0268	.0630	.0213
Personal Decorations	.1491	.1783	.0283
NPS Graduate	.1500	.2240	.0739
Performance Index (GE 11.90)	.5622		
Performance Index (GE 11.78 & LE 11.89)	.3811		

Table 35. Results from Selection to Major Multivariate Regression Models.

Model 1, which incorporates the performance index, shows the value of the variables with performance differences accounted for and held constant. Model 2 does not account for performance and, therefore, the variables in Model 2 are reflecting differences in performance. For example, the race variable in Model 1 shows that when performance differences between white officers and non-white officers are not allowed to influence the variable's effect on selection, the differing rates of selection between white and non-white officers is only eleven one-hundredths of a percentage point--virtually zero. However, when performance differences are not held constant, differences in performance between white and non-white officers affect selection rates. Therefore, Model 2 shows that whites increased their likelihood for selection to major over non-whites by six percentage points, all else equal. Table 4 shows that white officers had a .07 higher mean performance index than non-white officers and a 12.41 percent greater selection rate. Model 2 is sensitive to those differences. Model 3 shows that, by being white, an officer could expect his performance index to be .0522 higher than the performance index of non-white officers, all else equal.

The NPS graduate variable is just as revealing. When performance differences are accounted for and held constant, NPS graduates could expect to increase their likelihood for promotion by 15 percentage points over non-NPS graduates, all else equal. When performance differences are not accounted for and not held constant, NPS graduates increased their selection likelihood by 22.40 percentage points over non-NPS graduates. In Model 3, NPS graduates could expect to have had a performance index that was .0739 points higher than an officer who did not attend the NPS, all else equal. Tables 10 and 11 show that NPS graduates had a higher mean performance index and, consequently, a higher rate of selection to major than non-NPS graduates. Model 2 is showing its sensitivity to these differences by awarding NPS graduates a 7.22 percentage point higher selection likelihood over Model 1.

Finally, the values for the performance indexes are very large, but expected. If an officer in the captains in-zone data set had a performance index of 11.90 or higher, that officer's selection likelihood is 56 percentage points greater than officers with a performance index less than 11.78. Put another way, officers who, on average, were

consistently rated in the top 20 percent of their peers could expect to increase their likelihood of being selected for major by 56 percentage points over officers who, on average, were consistently rated in the bottom 49th percentile of their peers. A similar trend holds true for officers with a medium performance index. These officers, clustered in the top 50th to 79th percentile, could expect to increase their likelihood of being selected for major by 38 percentage points over officers in the bottom 49th percentile, all else equal.

NPS GRADUATES PROMOTION TO MAJOR MULTIVARIATE REGRESSION MODELS

	MODEL 4	MODEL 5	MODEL 6
Variable	**Parameter Value**	**Parameter Value**	**Parameter Value**
Mos Match	.2414	.1784	- .0004
High Performance (GE 11.90)	.6104		
Medium Performance (GE 11.78 & LE 11.89)	.4229		

Table 36. Results from NPS Graduates Selection to Major Multivariate Regression Models.

Models 4, 5 and 6 are restricted to only NPS graduates. Model 4 shows a nearly 24 percentage point increase in the likelihood of selection if the officer's MOS coincided with his/her selected NPS curriculum over an officer whose MOS and NPS curriculum did not coincide. This should not be surprising. An officer with a financial management MOS who graduates from the financial management curriculum, then is immediately ordered to a pay-back tour in some financial management capacity, should expect his/her promotion likelihood to increase when compared to that of an artillery officer in the financial management curriculum, for example, as the former would have

established more MOS credibility. The technical curricula variable was not regressed since officers who graduated from the NPS in the technical curricula constituted the bulk of the officers passed-over for promotion to major in 1993 and 1994. However, upon closer examination of the data set, the high rate of being passed-over was probably more a function of below-average performance indexes than the curricula themselves. Even when controlling for differences in performance, the technical curricula variable would have been very large and negative, implying a strong relationship between non-selection and the technical curricula which may not be true.

PROMOTION TO LIEUTENANT COLONEL
MULTIVARIATE REGRESSION TABLES

	MODEL 1	MODEL 2	MODEL 3
Variable	Parameter Value	Parameter Value	Parameter Value
Male	-.1293	-.0636	.0323
White	.0694	.1880	.1183
USNA	.0866	.1170	.0397
NROTC	.0383	.0269	-.0066
Other Commissioning Sources	-.4696	-.2651	.0864
Pilots	.0654	.0266	.0033
Aviation Support	.0985	.0073	-.0493
Service Support	.1697	.0982	-.0358
Ground Support	.1340	-.0351	-.1005
GCT Score (GE 135)	-.0461	-.0222	.0123
GCT Score (GE 125 & LE 134)	-.0281	-.0108	.0221
Personal Decorations	.0905	.1146	.0241
NPS Graduate	.0617	-.0030	-.0149
Performance Index (GE 11.79)	.6638		
Performance Index (GE 11.66 & LE 11.78)	.4230		

Table 37. Results from Selection to Lieutenant Colonel Multivariate Regression Models.

The lieutenant colonel promotion models show, as did the major promotion models, that when the performance indexes are omitted from Model 2, the value of the relationships between the variables and selection rates often change. Some interesting relationships are uncovered in Table 37. For instance, the occupational specialties with the highest promotion probability are the service and ground support specialties even though they could expect their performance indicators to be lower than that of the combat specialties. A possible explanation is that the service and ground support specialties are chronically underpopulated. The selection board, aware of this, may be selecting these majors in-zone for promotion even though their performance, on average, is lower than that of the combat specialties.

The GCT score coefficients are negative, although rather small in value. This negativity is an indication that for selection to lieutenant colonel, GCT scores were a poor predictor of success.

Finally, NPS graduates had a 6 percentage point greater likelihood of selection to lieutenant colonel than the other majors in-zone who did not graduate from the NPS. This is interesting because in this data set, NPS graduates have, on average, a lower performance index than non-NPS graduates. The number of observations in the majors in-zone data set were too few to conduct any meaningful regression analysis.

V. CONCLUSIONS

From the results listed in the preceding chapter, it is clear that including a variable to account for performance and thus, hold performance differences constant makes the strength of the relationship between the explanatory variables and selection to major or lieutenant colonel more reliable. For promotion to major, with performance held constant, strong relationships existed between selection and accession source, occupational specialty, personal decorations and graduating from the Naval Postgraduate School. For promotion to lieutenant colonel, also with performance held constant, strong relationships existed between selection and race, accession source, occupational specialty, personal decorations and graduating from the Naval Postgraduate School. Gender does not appear to be a strong indicator. Even though in both the major and lieutenant colonel promotion models, females overall seem to have a much higher propensity for promotion, the extremely small number of females in each data set, combined with their high selection percentage, is inflating the difference in selection likelihoods between males and females. A larger number of females must be studied before any reliable relationship between selection and gender can be made. For promotion to both grades, the strongest and most consistent indicator of selection is an above-average performance index. The strong correlation between selection and performance dwarfs the relationship between selection and any other explanatory variable.

The analysis of the data also indicates that the selection boards are selecting officers based primarily on their past performance of duty. Even though Marine Corps officer fitness reports suffer from hyper-inflated marks, when the marks are indexed, reliable differences in the indexes do exist. Although the variation is numerically very small, the major and lieutenant colonel selection boards are able to discern those differences and are consistently promoting the officers with the higher performance indexes.

Finally, why do NPS graduates enjoy higher selection rates to both major and lieutenant colonel? It is clear that for promotion to major, NPS graduates have, on

average, higher performance indexes which are translating into higher selection rates. For selection to lieutenant colonel, the differences in the performance indexes are negligible; however, the multivariate regression models indicate that majors in-zone who were graduates of NPS should expect their selection rate to be higher than officers who did not attend the NPS when performance and other explanatory variables are held constant. The most credible explanation for NPS graduate's higher selection rate is the Special Education Program selection boards are simply doing a very good job in selecting officers to attend NPS -- officers that probably would have been selected for major and lieutenant colonel regardless of their selection to attend the Naval Postgraduate School.

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